

**ABSTRACT**

An ion implanter includes an ion source for generating an ion beam, an analyzer for separating unwanted components from the ion beam, a first beam transport device for transporting the ion beam through the analyzer at a first transport energy, a first deceleration stage positioned downstream of the analyzer for decelerating the ion beam from the first transport energy to a second transport energy, a beam filter positioned downstream of the first deceleration stage for separating neutral particles from the ion beam, a second beam transport device for transporting the ion beam through the beam filter at the second transport energy, a second deceleration stage positioned downstream of the beam filter for decelerating the ion beam from the second transport energy to a final energy, and a target site for supporting a target for ion implantation. The ion beam is delivered to the target site at the final energy. In a double deceleration mode, the second transport energy is greater than the final energy for highest current at low energy. In an enhanced drift mode, the second transport energy is equal to the final energy for highest beam purity at low energy.